Vadose Zone Fact Sheet
Paducah Gaseous Diffusion Plant

Background: The Paducah Gaseous Diffusion Plant (PGDP), located 24 km (15 mi) west of Paducah, Kentucky, is an active DOE owned facility that enriches uranium using the gaseous diffusion process for both government and commercial nuclear power reactors. The site covers 1,418 hectare (3,500 acre) in total, which includes 389 hectares (960 acres) within the plant boundaries and 30 hectares (74 acres) of process buildings.

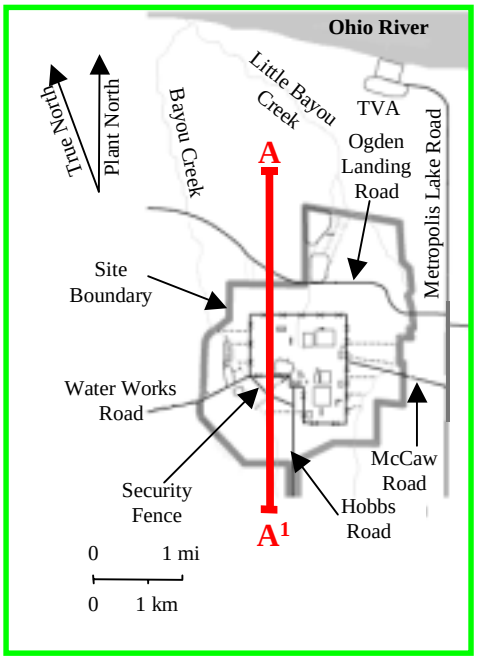
Issues: Recently, allegations of unauthorized waste burial and worker health concerns have increased stakeholder awareness.

Vadose zone infiltration: The amount of precipitation that infiltrates into the ground water system is estimated to be 12 cm (4.7 in) per year. From June through October, evapotranspiration is generally higher than precipitation, so nearly all the vadose zone infiltration occurs from November through May.

Vadose zone characterization/remediation: Initial characterization has been completed and the site is in the remediation phase. Numerous removal actions have been completed. PGDP has implemented an innovative technology known as Lasagna^{tm} to lower trichloroethylene (TCE) concentrations in soils. Lasagna^{tm} is an in-situ technology that uses electro-osmosis to mobilize moisture and contaminants in fine-grained or clayey soils. The contaminants are treated as they pass through in-ground treatment cells. PGDP is also developing alternatives for removing polychlorinated biphenyl (PCB) from soil.

Precipitation: The average annual precipitation is 127 cm (50 in).

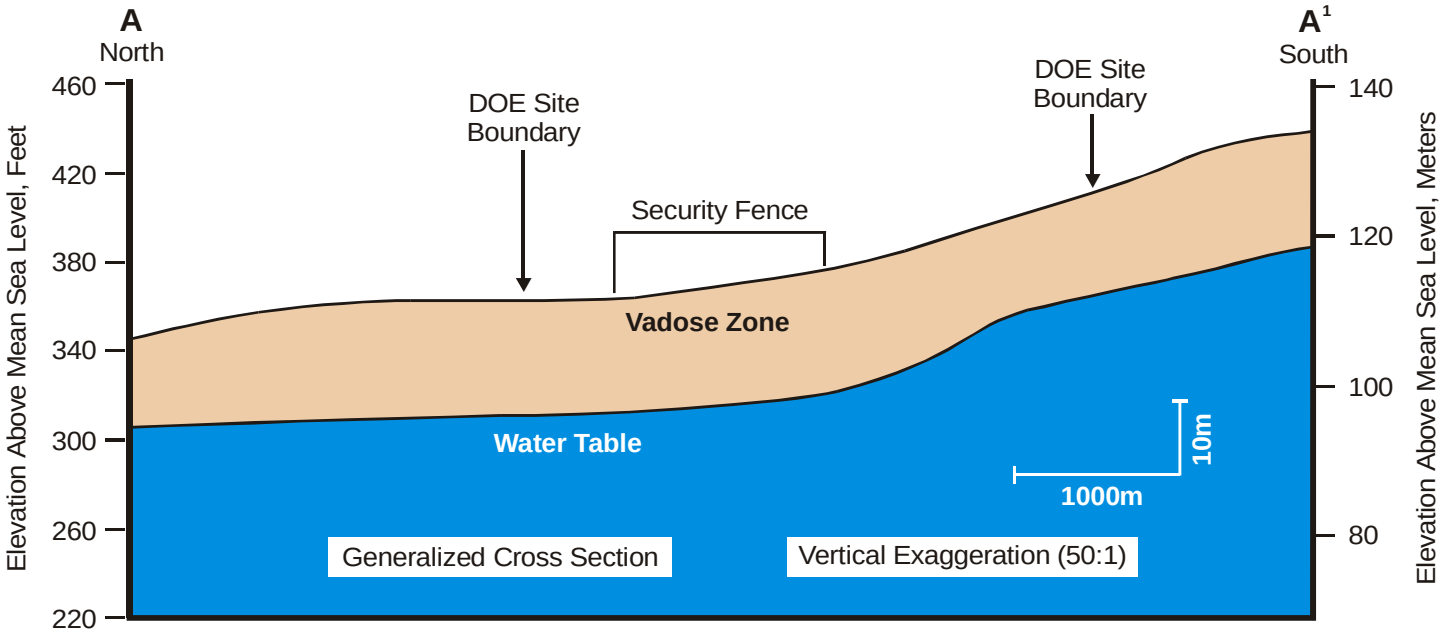
Surface Waters: Approximately 100 small lakes and ponds, 7 settling basins, and 17 gravel pits exist on the property. The plant is drained by the Bayou Creek, Little Bayou Creek, their tributaries, and man-made drainage ditches. Creek flow is northward toward the Ohio River. A 67-hectare (165-acre) wetland exists on-site immediately south of the confluence of the Bayou and Little Bayou Creeks.



Geology: The geology is very complex with several hundred feet of unconsolidated sediments overlying the bedrock. Local elevations range from 88 to 137 m (290 to 450 ft), and 110 to 119 m (360 to 390 ft) within the plant boundaries. The site slopes generally to the north.

Vadose zone thickness: The average depth to the regional aquifer is 18 m (60 ft).

Major contaminants of concern: Technetium-99, PCB, and volatile organic compounds, primarily TCE and dichloroethylene.



September 2000

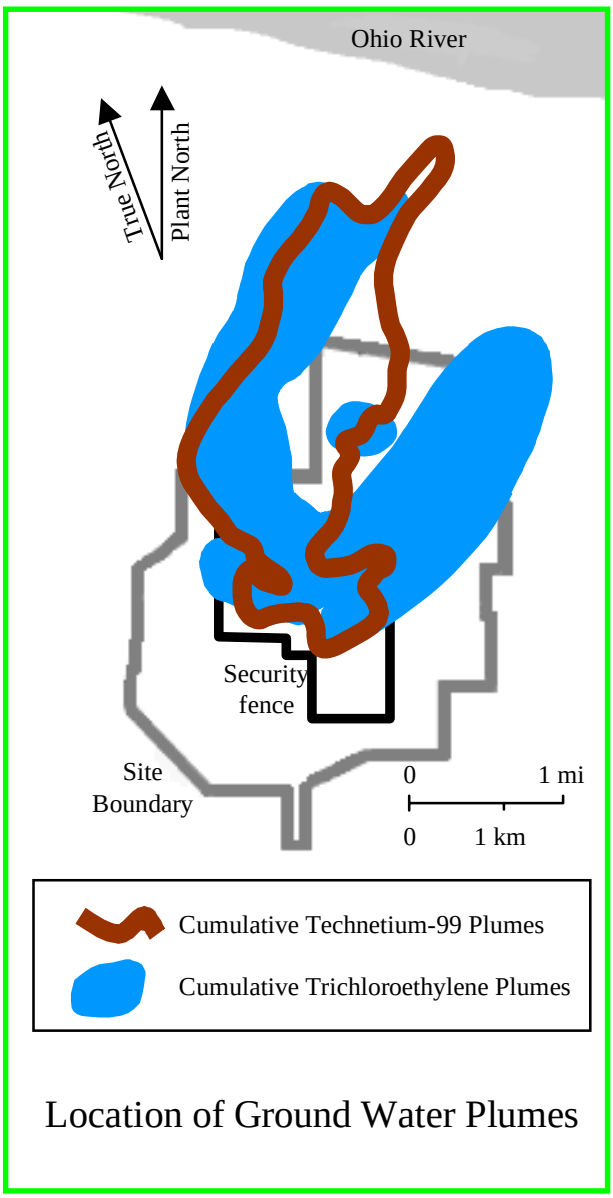
Ground Water Fact Sheet
Paducah Gaseous Diffusion Plant

Background: The Paducah Gaseous Diffusion Plant (PGDP), located 24 km (15 mi) west of Paducah, Kentucky, is an active DOE owned facility that enriches uranium using the gaseous diffusion process for both government and commercial nuclear power reactors. The site covers 1,418 hectare (3,500 acre) in total, which includes 389 hectares (960 acres) within the plant boundaries and 30 hectares (74 acres) of process buildings.

Hydrogeology: The ground water flow system at PDGP exists primarily within unconsolidated sediments. The hydrogeology is very complex, with numerous water bearing zones in several formations. Precise deliniation of and correlation between the saturated zones are hard to ascertain with a high degree of confidence. The uppermost and dominant aquifer in the flow system at the site is the Regional Gravel Aquifer (RGA). Many plumes have been identified within the RGA. The RGA exists as a semi-confined to confined aquifer. Regional ground water flow is north towards the Ohio River.

Issues: Ground water contamination was discovered in August 1988 at off-site residential drinking water wells. Municipal water hookups have been provided to residents and businesses within the projected migration area of the contaminated ground water. Hydraulic containment of off-site migration of contaminated ground water has been achieved. Large quantities of dense non-aqueous phase liquids (DNAPLs) are present at the site (estimated to be as high as 790,000 liters [210,000 gal]) and are located at the base of the aquifer. Techniques for locating and remediating DNAPLs from soil and ground water are being developed.

Ground water characterization/remediation: Initial characterization has been completed and interim remedial actions have been implemented. Potential sources of contamination include burial grounds, spill sites, and container storage areas. Three ground water plumes/groups of plumes have been identified: the Northwest Plume, the Northeast Plume, and the Southwest Plume. Interim remedial actions to date include extraction and treatment of contaminated ground water from the Northwest and Northeast Plume. The technical remedial approach is to address contaminant source terms, such as the C-400 area where the vadose zone and shallow ground water exhibit TCE contamination, with vapor and liquid extraction systems. Thermal removal technologies such a six-phase heating and dynamic underground stripping with dual phase extraction is planned for removing DNAPLs from deeper aquifers and source areas. To further remediate the plumes, plans are to install reactive barrier systems for each plume at the plant boundary. A pilot project is underway to install a permeable treatment zone at the Southwest Plume. In-situ chemical oxidation and bioremediation technologies are also planned to address the dissolved portion of the plumes.



Location of Ground Water Plumes

Ground water use: The major ground water use in the area is residential, but no residences or businesses in the impacted zones are connected to private sources.

Contaminants	Depth	Remedial Approach
Trichloroethylene (TCE); technetium-99	30 m (100 ft)	Pump and treat; steam flood; monitored natural attenuation; vapor extraction; dynamic underground stripping; reactive barrier walls; in-situ chemical oxidation; bioremediation; innovative technology development